

## SOME SOUTH INDIAN BATRACHIANS.

BY

C. R. NARAYAN RAO, M. A

Central College, Bangalore.

[With two plates.]

These notes discuss a portion of the material collected some time ago in certain parts of Coorg and Shimoga, and I propose to include in this paper a few remarks on some of the unidentified examples of batrachians belonging to the Bombay Natural History Society, entrusted to me for determination. Through the courtesy of Dr. N. Annandale I have had access to the named collection of amphibians in the Indian Museum, and I should like to thank him and Dr. Boulenger who has very kindly examined a few specimens submitted to him for his opinion.

Two specimens belonging to the species *Spelerpes fuscus* are contained in the Society's collection and the label on the specimens shows that they are from Burma. There are a few points in which these two examples differ from the description of *fuscus* given in the Catalogue of the British Museum. For instance, 1. The remnants of cirri or balancers are absent below the nostrils in both the specimens. 2. The distance between the snout and the gular fold is less than three times in the length of the snout and the vent. 3. Two parotoids are present in both examples. 4. The deep groove behind the gular fold is continuous with the cervical groove starting from the posterior angle of the eye. 5. A lateral glandular fold over the costal grooves (9-10) is present. 6. Total length from tip of snout to tip of tail 105mm., more than 4 in. (a) 7. The tail is marbled. Considering the locality that the specimens are alleged to come from and also in view of the fact that the characters enumerated above are constant in the two forms, I naturally thought whether they could not be distinct from *fuscus*. But Dr. Boulenger who has examined one of the specimens, identifies it as the European *Spelerpes fuscus* and states that it could not have been picked up in Burma. (b) The only species of *Spelerpes* present in the Indian Museum is *S. ruber*, No. 2712 from North Carolina, and there is practically no further material in India for comparison. As the source of these salamanders cannot be definitely traced for the present, the interpretation of Dr. Boulenger is certainly the more natural and correct one.

Among the unidentified examples of batrachians belonging to the Society I found 1. *Rana pileata*, 2. *R. plicatella*, 3. *R. erythraea*, 4. *Rhacophorus bimaculatus*, 5. *Galophrynus pleurostigma*, 6. *Kaloula pulchra*, 7. *Bufo melanostictus*, 8. *Leptobrachium hasseltii*? All these are from Burma, except *Rh. bimaculatus* which I found in Mr. Kinnear's collection from Somavarapatna, Coorg. The occurrence in South India of this species which is known to affect the rain forests of Assam is certainly very interesting and is reported here for the first time. The two specimens of *Cal. pleurostigma* are in a beautiful state of colour preservation and the scheme of markings on them closely conforms to the description of

---

(a) Dr. Boulenger's measurement for the male specimens is 96mm, and Dr. Gadown (Camp, Nat. Hist. Amp. Rept., p. 105) states that the total length of *fuscus* remains under four inches.

(b) The only two salamanders known from this region are *Tyrototriton verrucosus* and *Amblystoma persimile*.

*Engystoma interlineatum* (c) rather than Boulenger's account (d). The ventral surface bears in both the examples beautiful white roundish or squarish spots, not alluded to by any previous writers and such as are present in some species of *Megalophrys*.

Only the following examples of batrachia included in my collection call for observation at present.

*Rana hexadactyla*, Less.

1890. *Rana hexadactyla*, Boulenger, Faun. Brit. Ind. Rept. Batr., p. 441.

*Larva.*

1904. *Rana hexadactyla*, Fergusson, J. B. N. H. S., Vol. XV., p. 500.

A young specimen measuring 23 mm. taken in Jog, Shimoga Dist., shows the following peculiarities as compared with examples of similar size.

1. The strong fold of skin behind the eyes and across the head is continued over the tympanum on each side.
  2. Pearl-like granules crowd over the body and the limbs and toes
  3. First finger equals the second.
  4. A very distinct canthus rostralis.
  5. Nostrils with valve-like flaps.
  6. The tibio tarsal articulation reaches beyond the eyes
- This specimen has been sent to the Indian Museum.

*Rana tigrina*, Daud.

1890. *Rana tigrina*, Boulenger, Faun. Brit. Ind. Rept. Batr., p. 449.

1915. *Rana tigrina*, Nicholls, Proc. Zool. Soc. London, pp. 603, 609.

1917. *Rana tigrina*, Annandale, Mem. As. Soc. Bengal, Vol. VI, p. 112.

1918. *Rana tigrina*, Id. & Boulenger, Rec. Ind. Mus., Vol. XV, 51, 67.

*Larva.*

1904. *Rana tigrina*, Ferguson, J. B. N. H. S., Vol. XV, p. 501.

1917. *Rana tigrina*, Annandale, Mem. As. Soc. Bengal. Vol. VI, p. 125.

The variations observable in this species are quite striking and are associated with the different modes of life adopted by the individual members. In the Mysore State, *e. g.*, Bangalore as in Madras town both this species and its variety *crassa* occur together and though both are of robust build their powers to stand captivity are so small, that any prolonged observations on their habits in a vivarium becomes almost impossible. My own experience is that the fossorial habits are by no means confined to *crassa* and I have on several occasions exhumed specimens of *tigrina* S. S. while digging for earthworms. The presence of a horny plate on the roof of the mouth or on the sides of the lower jaw of the larvæ is purely arbitrary and indicates nothing. In my opinion it would not be perfectly safe to use this character as a basis for specific or racial distinction. The dental formula ascribed to the tadpole by Dr. Annandale (e) does not provide for the outer limits of variations and the description of Dr. Boulenger (f) would be correct if the formula is written thus, 1 : 3 or 4/3 or 4 : 1.

The osteological characters of *Rana tigrina* recently described by Dr. Nicholls would appear to be subject to a great deal of variation and the following description refers to the more important of them. He compares the vertebral column of the Indian bull frog with that of the European

(c) J. A. S. B., 1854, Vol. XXIII, P. 732,

(d) Faun. Brit. Ind. Rept. Batr., 1890, p. 490.

(e) 1917, Mem. As. Soc., Bengal, Vol. VI., p. 125.

(f) 1918, Rec. Ind. Mus., Vol. XV., Part II, 57.

*R. temporaria*, and Dr. Annandale (*g*) states that he has been able to confirm the observations of Dr. Nicholls on most of the bones by an independent examination. In South Indian colleges where practical zoology is taught, the laboratory type is *R. hexadactyla*, and during the breeding season of frogs, examples of *R. tigrina* are frequently brought to the class for practical work. The skeleton of a *R. tigrina* S. S. prepared for the Central College recently showed certain abnormal individual variations and led to the making of a large series of skeletons of this species for the purpose of comparison. On a careful examination of these series with the skeletons of *R. hexadactyla* and *R. cyanophlyctis*, I am not able to confirm some at any rate of the statements of Dr. Nicholls.

(*a*). The vertebral column :—In regard to the neural arches, *R. tigrina* is said to show, “a very marked overlap of each arch dorsally upon that immediately posterior to it and accordingly when the vertebræ are in position, the centra are not visible from above (*h*)”. “In this imbricate condition of the vertebral column, it would appear then, that *R. tigrina* has retained (or reverted to) a somewhat primitive condition (*i*)” such as is met with in the families of *Discoglossidæ* and *Pelobatidæ*. The condition, shown in text fig. 1 of the paper cited, in support of the above statement, is easily produced by a bend or flexure such as appears in badly prepared skeletons, (*j*) and ; however, in carefully prepared bones the neural arches only notch between the zygapophyses (*k*) so as to produce a more or less open-work condition that Dr. Boulenger (*l*) describes as being characteristic of the genus *Rana*. I possess two skeletons of *R. esculenta* and a comparison with them or with the two other Indian species already mentioned, discloses nothing strikingly different in the vertebral column of *tigrina*. I may further mention that its vertebral column is certainly not like that of *Discoglossus pictus* (*m*) and the figure of Dr. Nicholls therefore does not represent the correct position of the neural arches in well prepared and normally articulated spinal column. It is further pointed out that the imbricate condition of the neural arches is produced in *tigrina* as in *Pelobates fuscus*, by the fact that in these examples the centrum has practically the same length as the neural arch (*n*). In the vertebræ of *R. tigrina* that I have forwarded to Dr. Annandale, the length of the centrum is  $1\frac{1}{2}$  of the length of the neural arch measured along the median line. This holds not only for the sixth vertebra that Dr. Nicholls selects for comparison, but for all others in the series. The dorsal view of the vertebral column of *R. tigrina* is not, however, the fully and completely open-work condition figured for *R. temporaria* by Howes (*o*) and for *R. esculenta* by Ecker, (*p*) and the seemingly imbricate appearance is due to,—1. The largely developed neural spines, directed backwards hiding the vertebral gaps. 2. The pre and post zygapophyses are considerably flattened and hide the communications between the dorsal gaps and the vertebral foraminae, and 3. On the posterior border of the neural arch of some of the vertebræ, a flange or arcualium is developed.

(*g*) 1917, Mem. As. Soc., Bengal, Vol. VI, p. 124.

(*h*) 1915, Proc. Zool. Soc., p. 603.

(*i*) 1915, *ibid.* pp. 603-604.

(*j*) All osteological material in support of these statements are sent to the Indian Museum.

(*k*) This is true of *R. hexadactyla* and *R. cyanophlyctis* also.

(*l*) 1897, the Tailless Batrachians of Europe, Vol. I. p. 38.

(*m*) 1907, *Wiedersheim* and Parker Comp. Anat. Vert., p. 56.

(*n*) 1915, Proc. Zool. Soc., London., p. 605.

(*o*) 1902, Howes, Atlas Pract. El. Zool., pl. IV., fig XXXV.

(*p*) 1889, Ecker. Anat. Frog., p. 18.

In regard to the development of the neural spines, I agree with the statement of Dr. Nicholls (p. 606) and I find that the neural spine of the seventh vertebra is as upright as that of the eighth. The cartilaginous ribs of the third vertebra of *R. tigrina* are said to be very like those of *P. fuscus* and this condition is obviously common to more than one Indian frog. The third vertebra of some of the examples of *hexadactyla* also show this character and the third vertebra of these two Indian species are to be distinguished by a flange or an osseous tubercle in *tigrina* alone. This tubercle or flange may perhaps represent the partial bifurcation of the diapophyses described by Dr. Bourne (g) as an abnormal occurrence in *temporaria*. As regards the diapophyses of the eighth vertebra, it may be mentioned that its stouter nature is rather an exception than a rule, and in the specimens that I have sent to the Indian Museum they will be seen to be not bigger than the transverse process of the seventh vertebra. The sacral diapophysis is certainly cylindrical in *tigrina*. I entirely agree with the description of the coccyx in Dr. Nicholls's paper, but in respect of the shoulder girdle, although there is a slight overlap, the ventral suture of the two corocoids which meet in a median bar in front, passes through the median axis of the girdle. Dr. Nicholls's text fig. 3A showing the right corocoid beyond the mid-ventral line, is rather an exaggeration. The overlapping condition is certainly a primitive feature which *tigrina* has retained, and in the metamorphosing larvæ of this, as in other Ranid larvæ (r) it is the epicorocoidal cartilages that overlap and the left corocoid bone extends slightly dorsally over the right, while ventrally they meet in a median suture.

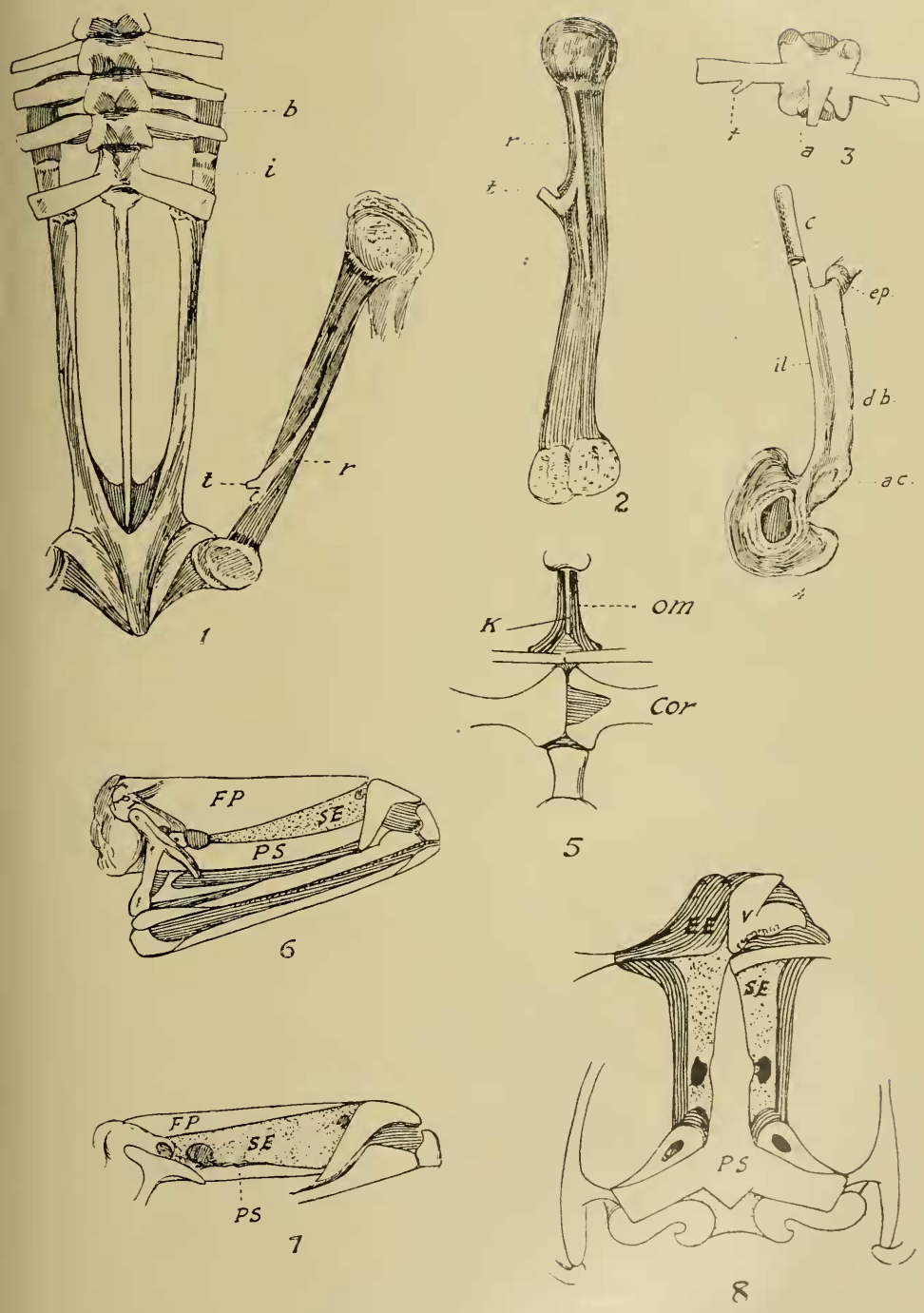
(b). The skull:—Dr. Boulenger appends a short description of the skull of *R. tigrina* to his definition of the species (s) and in certain regards it needs amplification. The cartilaginous basis of the skull is really confined to the processes given off from the nasal capsule which is, however, perfectly ossified; the principal processes being the transverse ones meeting the cartilaginous epiphyses of the pterygoid, the anterior and the anterolateral and the alar cartilages. The floor, the roof and the septum of the olfactory capsule are ossified by the great development of the othmoid bone—the cornets are present in the form of powerful turbinated bones. The large nasals which overlie the bony capsule,—occasionally with bony outwardly a very short directed spines,—are united with one another and with the frontoparietals so completely that the sutures may be lost or may be faintly indicated by grooves. The osseous floor of the nasal capsule is underlaid by two equally large vomers the outer borders of which have two processes enclosing a deep notch between them,—the anterior process almost meeting the maxillary bone, while teeth are borne on the postero-lateral border. The sagittal and coronal sutures are only indistinctly marked or not at all, and the upper surface of the skull is either flat or slightly convex (noticed in *R. temporaria* and *R. oxyrhinus* (t)). The parietal ridge is generally strongly marked, extending backwards to the apex of the heart-shaped foramen magnum. The mastoid ridges and the mastoid elevations are prominent. The lateral cartilaginous portions of the cranium are completely replaced by the backward extension of the sphenethmoid which is incorporated behind into the ala magna. Thus the foramen pro ramo-nasalis, foramen opticus and foramen oculomotorius are simple perforations in the sphenethmoidal bone. In some specimens the downward prolongation of

(g) 1894, Bateson, Mat., Stud. Var., p. 124, and 1884, Bourne, Q. J. M. Sci., XXIV, p. 86.

(r) 1901, Gadow., Camb. Nat. Hist., Amph. Rept., p. 25.

(s) 1918, Rec. Ind. Mus., Vol. XV., p. 57.

(t) 1889, Ecker, Anat., Frog. p. 23.



SOUTH INDIAN BATRACHIANS.

the fronto-pariels may meet the upward extension of the parasphenoid in front of the exit of the optic nerve. The foramen trigeminus is a large vertically oval aperture and in some specimens of skulls, is constricted slightly in the middle by the approximation of tongue-like processes of the sphenethmoid and the ala magna. The ophthalmic branch of the fifth, the sixth and the palatine branch of the seventh occupy the dorsal part of the foramen, while through the lower half of the foramen emerge the maxillo-mandibularis of the fifth and the hyo-mandibularis of the facial nerves. The trochlear nerve has no separate exit and issues through the foramen opticus. The canalis nervi vagi may bear three orifices,—though the usual number is only two,—the internal foramen condyloidium for the exit of the vagus and glossopharyngeal nerves and two lateral ones for the entry of the internal and the external carotid arteries. The maxillo—palatine process is large and extending below the nasals, supports the cartilaginous epiphyses of the pterygoid and the transverse cartilaginous extension from the nasal capsule.

(c). The individual abnormal variations.—

i. The pelvic girdle. In the preparation I have forwarded to the Indian Museum the ventral border of the ilium extends far beyond the sacral diapophyses and before maceration, was continued over the transverse processes of the eighth and the seventh vertebræ by means of a flat cartilaginous bar. In accordance with this fact the diapophyses of these vertebræ are flattened into wing-like expansions at the base, thus deviating from the cylindrical shape. The dorsal blade of the ilium is practically of the same depth throughout and it is the terminal portion of this sharp border, which unites with the transverse process of the sacral vertebra by a cartilaginous epiphyseal connection.

ii. The femur. The inner border of the right femur bears a strongly developed tubercle or a process projecting in the living specimen between the great adductor and internal vastus muscles. There is a distinct ridge on the ventral surface of the bone, running from the head of the femur to more than half the distance. A similar but fainter ridge is found on the dorsal face also.

iii. The pectoral girdle. The inner end of the left corocoid is distinctly forked and a mass of epicorocoidal remains persisted in the living condition, in front of the corocoidal suture. The future is imperfect on account of the deficiency of the left corocoid. The ventral face of the bony style of the omosternum bears a strong carina-like ridge throughout its length.

*Rana leptodactyla*, Boul.

1890. *Rana leptodactyla*, Boulenger, Faun. Brit. Ind. Rept. Batr., p. 448.

*Larva*.

1918. *Rana leptodactyla*, Annandale, Rec. Ind. Mus., Vol. XV., p. 19.

I have had opportunities of witnessing the spawning of this frog in Coorg and could rear the larvæ only up to the two-legged stage. I am of opinion that the tadpoles described by Dr. Annandale in the paper cited, do not belong to *R. leptodactyla*. I have myself examined the tadpoles No. 17698 contained in the Indian Museum collection, and I have in my own collection other tadpoles quite identical with this number, a few of these latter tadpoles with me have developed the feet. Judging from this and other characters I am led to infer that the examples described under *leptodactyla* may prove to belong to one of the species of *Nyctibatrachus*. I am forwarding

to Dr. Annandale these suspicious looking larvæ and other material, and at present I am not in a position to say anything regarding the larvæ he describes under *N. pygmeus* (u).

The eggs of *R. leptodactyla* are large, measuring with the gelatinous outer coat  $4\frac{1}{2}$  mm. and are laid in small clumps at several places along the grassy margins of the ponds. The sexual embrace is axial. The total number of eggs included in any one batch does not usually exceed thirty, and the batches of eggs deposited by any one frog in the different parts of the same pond may vary from six to eight. The localities for spawning are most arbitrarily selected and have no reference to protection or development being ensured. The debris that usually collects round the margins of ponds fed by storm-water confers, however, some measure of protection. The gelatinous outer envelope of the eggs which swells out into a large spherical mass in the water, shrinks in the preserving fluid. The two poles of the eggs are not distinguished by any colour.

The tadpoles are of moderate size, oval, rather flattened above (elevated in the young). The ventral surface is convex. The snout is obtusely pointed. The nostrils are widely separated, nearer to tip of snout than to eyes. The inter nasal space is only half the inter orbital width. The eyes are dorsal and directed upwards in the young, but outwards in the older forms. Eye nearer to the snout than to spiracle. The spiracle is lateral, not visible from above, sinistral, tubular, pointing backwards and upwards. It is nearer to the root of hind leg than to tip of snout. A frontal gland is present. The mouth disk is moderate, ventral in position. Lips opposible, the lower fringed with a double row of fingers-like processes, which extend on the emarginate sides. The upper beak is broadly semilunar, produced more or less in the middle into a blunt tooth-like process. The lower beak is V-shaped and the margins of both the beaks are entire. The dental formula is  $1: 2 + 2/1 : 2$  or  $3$ . The upper entire tooth row is the longest and the other two are broadly interrupted. The innermost lower series is either narrowly broken or entire and all the three series are equally long. The vent is dextral, tubular. The tail is long, pointed at the tip. The muscular part at the middle of tail is as deep as the membranes,—these are poorly marked in front but are deep and convex behind. The dorsal surface of head and body is olive green or brown, more or less speckled. The ventral surface whitish, immaculate. The tail is spotted throughout.

Measurements of a specimen in which the hind limbs are fully grown:—

Total length .. .. .	43mm.
Length of head and body .. .. .	18mm.
Greatest breadth of body .. .. .	11 $\frac{1}{2}$ mm.
Greatest depth of body.. .. .	10mm.
Greatest depth of tail .. .. .	7mm.

The eggs and specimens of tadpoles were obtained at Watekollé, Coorg, in December 1918 and were taken also in Shimoga, Mysore State. Twelve hours after the deposition of the eggs, the young one are found wriggling in their gelatinous envelopes, which gradually spread out into a continuous film over the water. This viscous mass becomes completely dissolved, before the final emergence of the larvæ takes place. Buds of hind limbs sprout nearly a fortnight later, which is certainly a remarkably short period for the Ranid larvæ in general and the rapidity in the present case is correlated with the fact that metamorphosis has to be completed before the element in which the larvæ live should dry up.

The eggs and the tadpoles are in the Indian Museum.

*Nyctibatrachus sancti-palustris* sp. nov.

♂ Vomerine teeth in two strongly set, large oblique series, behind the choana,—considerably further behind in the young. Habit moderate. No canthus rostralis, which in the young is obtuse. Length of snout nearly equals the diameter of the eye in the adult, but longer in the young. Eyes moderately prominent, directed upwards and forwards. The upper eye lid is narrow and smooth in the young and covered by warty folds in the adult. The inter orbital space is slightly wider than the upper eye lid. Nostrils equidistant between the eye and tip of snout. Snout obtuse in the young, broadly rounded in the adult. Fingers moderate, first shorter than the second; tips swollen, truncate. Toes more than half webbed, tips dilated into disks. Subarticular tubercles moderate. An inner metatarsal tubercle. Tarso-metatarsal articulation reaches the eye or slightly beyond. Skin nearly smooth in the young but covered by short semicircular folds on the back and the sides, in the adult. A median fold on the snout, forking behind in the adult, but generally continued between the eyes in the young. A moderate sub-orbital fold and another from the eye to the shoulder. Reddish brown above, limbs barred. A broad dark band between the eyes. Throat bronzed in the adult, as also the under surface of limbs. Abdomen yellow, the liver showing through the transparent skin in the form of a squarish dark patch. In the young, the upper surface of the limbs is lighter, the dark bands extend on the toes. A triangular bright yellow mark on the snout and orange yellow streaks on the shoulder, sometimes continued to the groin in the young.

From snout to vent 39mm.

Locality.—The sacred swamps of the Cauvery, Brahmagiri hills 4,000 feet, Coorg.

The type and syntypes are in the Indian Museum. Dr. Boulenger has retained for the British Museum one of the three specimens which he kindly examined.

*Nyctibatrachus sancti-palustris modestus* var. nov.

This variety of the foregoing species differs in a striking manner and in several important particulars and for the purpose of comparison, I have selected examples of the same size.

1. The length of the throat along the mid-ventral line is  $\frac{1}{2}$  the distance measured ventrally between the angles of the mandibles in *sancti-palustris*, and in *modestus* it is  $\frac{1}{4}$ .

2. The length of snout equals the diameter of eye in *modestus*, exceeds by far in *sancti-palustris* of the same size.

3. Nostrils nearer tip of snout in *modestus*.

4. The inter orbital width more than twice the upper eyelid in *modestus*.

5. No canthus rostralis.

6. A more elongate metatarsal tubercle.

7. Tarso-metatarsal articulation reaches the snout or slightly beyond. Toes less fully webbed.

8. Skin thrown into long longitudinal folds on the body and limbs.

9. Pinkish above, more or less blotched. Limbs barred. Throat and under surface of limbs finely speckled. Abdomen white. An orange yellow band on each shoulder.

Total length 25 mm.

Locality.—Jog, Shimoga, Mysore State.

Type and syntype in the Indian Museum.

*Bufo*.

Two specimens of *Bufo* collected in Coorg appeared to me to be distinct from *B. stomaticus* which I had examined in the Indian Museum in June



1919. Dr. Boulenger to whom they were sent is, however, of opinion that they cannot be separated from *stomaticus*. With a view to verify my position, I have, through the courtesy of the Director of the Zoological Survey of India, been enabled to re-compare my material with the Indian Museum collection. At the end of the reconsideration, I find myself unable to accept the decision of Dr. Boulenger. For reasons given below I consider myself sufficiently justified in regarding the two examples as representing a distinct local race differing from their North Indian congeners in several important particulars. Though I do not possess at present sufficient material to establish their specific distinctness, which may perhaps prove the more correct view to take, I have no doubt about their being racially distinct.

*Bufo stomaticus peninsularis* var. nov.

Head without bony ridges or feebly marked by minute cornified tubercles. Snout obtuse, rather truncated obliquely. Interorbital space broader than upper eyelid. Tympanum moderate about  $\frac{3}{4}$  the length of the upper eyelid. First finger equals the second. Toes half-webbed, subarticular tubercles inconspicuous. Two meta tarsal tubercles,—the inner spade-like. Tarso metatarsal articulation reaches the tympanum. Skin perfectly smooth or covered uniformly by minute tubercles. Under surface non-tuberculate. A feebly marked flask-shaped fold over the occiput. Parotoids much flattened, inconspicuous. Cutaneous pores aggregated in small numbers over the skin. Colour of live specimens either pale buff or olive green more or less speckled with brown. Under surface yellow on a background of dirty white.

From snout to vent 45 mm.

Locality. Mavkote and Watekole, Coorg.

Type and syntype in the Indian Museum.

The enumeration of characters in which the variety *peninsularis* differs from *stomaticus*, (Indian Museum nos. 16067, 16068, 17254 and 17274) may now be proceeded with. They are all from Northern India. 1. The interorbital space is  $1\frac{1}{3}$  or  $1\frac{1}{4}$  of the upper eyelid in *peninsularis* and equals the upper eyelid in *stomaticus*. 2. The length of the snout is  $1\frac{1}{2}$  the length of the upper eyelid in *peninsularis* and is  $\frac{5}{7}$  in *stomaticus*. 3. The mandibulars symphysis form an acute angle in *peninsularis* and is a broad semicircle in *stomaticus*. 4. Inner meta-tarsal tubercle spade like in *peninsularis* and conical in *stomaticus*. 5. The vertical diameter of the tympanum is  $\frac{3}{4}$  the length of the upper eyelid in *peninsularis* and  $\frac{3}{7}$  in *stomaticus*. 6. The upper eyelid is entire, coterminous with the canthus in *peninsularis* and notched both ends in *stomaticus*.

*Bufo parietalis*, Boul.

1890 *Bufo parietalis*, Boulenger, Faun. Brit. Ind. Rep. Batr., p. 507.

A single specimen of this species 1.8 inches (*y*) is included in the collection and shows the following peculiar characteristics:—

1. The bony ridges are by no means prominent.
2. There is a distinct occipital and a prefrontal ridge.
3. Toes are considerably less than half-webbed and subarticular tubercles are absent.

Specimen in the Indian Museum.

EXPLANATION OF PLATES.

1. The abnormal *Rana tigrina*.

Fig. 1. The pelvic girdle and the abnormal femur.

Fig. 2. The abnormal femur showing the tubercle and the ridge.

---

(*y*) Dr. Boulenger's record is 3.25 inches, Faun. Brit. Ind. Rept. Batr., p. 507.



11



13



14



10



15



16



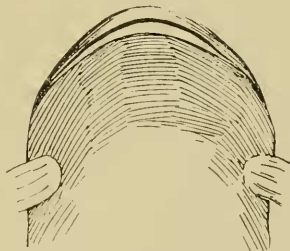
17



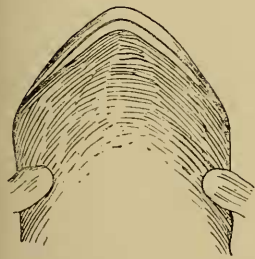
18



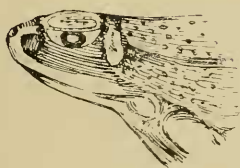
12



19



20



21



22

- Fig. 3. The third vertebra showing the tubercle on the diapophyses and the arcualium.
- Fig. 4. The abnormal ilium with the forward cartilaginous extension.
- Fig. 5. The pectoral girdle showing the forked left corocoid and the keeled omosternum.
- Figs. 6&7. Side views of the skull of the normal *R. tigrina*, showing the relation of the sphenethmoid, the frontoparietal and the parasphenoid bones, and their degrees of development.
- Fig. 8. Lower view of the skull shown in fig. 7. The right vomer is removed to show the bony base of the nasal capsule.

### 2. *Rana leptodactyla*.

- Figs. 9,10&11. Egg\* more than twice; tadpole\* twice; mouth\* more four times magnified.

### 3. *Nyctibatrachus*.

- Fig. 12. *N. sancti-palustris* sp. nov.
- Figs. 13&14. The under views of *sancti-palustris* and *modestus* var. nov. respectively.
- Figs. 15, 17 and 16, 18. The hind limb and the meta-tarsal tubercle of *sancti-palustris* and *modestus* respectively.

### 4. *Bufo*.

- Figs. 19, 21 and 20, 22. The throat and profile of *B. stomaticus* No. 17274 belonging to the Indian Museum and *peninsularis* var. nov.

Lettering.—a. Arcualium on the posterior border of the neural arch. ar. articular facet of the tendon of m. vastus externus.

C. cartilaginous bar extending over the transverse processes of the VIII and VII vertebræ.

Cor. corocoid with the forked end.

db. dorsal blade of ilium.

EE. ecto and mesethmoid bones.

ep. epiphyseal connection between the dorsal blade of ilium and sacral diapophysis.

FP. frontoparietal bone.

il. ilium. K. carina on the omosternum. om. omesternum.

PS. parasphenoid bone, r. ridge on the two faces of the femur.

SE. sphenethmoid bone. t. tubercle. v. vomer.